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THE STATISTICAL WORK OF THE UNITED STATES GOVERNMENT.*

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This is the first time that the American Economic Association and the American Statistical Association have met in joint session and the second time that they have in cooperation considered the topic which is now our theme. The memory of some older members of the two Associations instinctively runs back this morning to the time, more than eighteen years ago, when joint committees of these Associations met around a table in New York to consider the terms of a memorial to Congress in favor of a permanent Census Bureau. The attendance was large and representative; the sessions prolonged and animated, not to say stormy. Finally, the committees reached substantial agreement and the memorial then drafted exerted, I believe, an appreciable influence upon the decision of Congress five years later to make the bureau permanent.

Two earlier precedents are even more encouraging. The first significant improvement in American census practice was made in 1800, with the purpose of testing the health and longevity of the American population. An age classification of the free whites into five periods was then introduced. This concession to non-political considerations resulted directly from petitions originating with the recently reorganized Connecticut Academy of Arts and Sciences, and effectively supported by similar petitions from two older and more influential learned societies, the American Academy of Arts and Sciences at Boston and the American Philosophical Society, located at the seat of government in Philadelphia and under the presidency of Thomas Jefferson, then Vice-president of the United States.

The longest forward step ever taken by Federal statistics was probably that between the censuses of 1840 and 1850.

* Paper presented at a joint meeting of the American Economic Association and the American Statistical Association Princeton, N. J., December 30, 1914.

The changes then introduced were due in no slight degree to the egregious blunders in the census of 1840, to which students had called attention, and to petitions for an improved census emanating from the New York Historical Society and the then youthful American Statistical Association. In now debating the condition of federal statistics, with a view to determining our individual responsibilities as scholars and our collective responsibilities as learned societies towards its present and future status, these Associations are following a line of notable and cheering precedents.

If one hopes to contribute individually to the improvement of federal statistics, the first essential is a thorough knowledge of the actual conditions under which the work is done and of the field of inquiry with which the figures are concerned. It is seldom possible to get this knowledge from printed official reports. For example, the census of 1870 reported that 12 per cent. and that of 1910 that 21 per cent. of American Negroes were mulattoes. The obvious interpretation is that these two races have been intermingling rapidly since the Civil War. We are not informed that in 1910 for the first time many of the enumerators employed were Negroes, that private inquiries conducted by Negro enumerators have shown a proportion of mulattoes much greater than census returns of similar date and place, and that this administrative innovation may explain much or all of the reported increase of mulattoes. The figures do not prove and perhaps hardly strengthen the inherent probability that miscegenation has increased.

How many members of our Associations who use the statistics of immigration know, what they could hardly learn from the reports of the Bureau of Immigration, that the meaning of the word *immigrant* as its statistical unit has been several times altered by bureau circulars and the comparability of the figures for the successive years disturbed? How many know that until recently an immigrant "bird of passage" was counted as an immigrant when he arrived in the spring, was not counted when he departed in the fall, and was counted again as often as he returned? *

*See the writer's "Our Gain in Population Through Immigration" in *National Civic Federation Review*, Nov.-Dec., 1906, p. 7.

Closely related with this need for a thorough knowledge of any inquiry whose results one uses is the need for measuring or estimating the amount and direction of the error in the results. This is quite other than the probable error with which mathematical statisticians are concerned. It seeks to learn whether the reported figures are above or below the truth and by how much. In a complicated series of inquiries each set of answers has its own margin of error, and an estimate of one throws little light on another. The reported number of married women is slightly too large because for a woman to allege marriage is to state a claim; the reported number of divorced women is far too small because such a report is a confession of fault or failure.

The greater the importance of one's statistics for the purpose he has in hand, the stronger becomes the need of determining whether they may be trusted to the degree implied in the argument, just as the taller the building, the deeper and firmer must be its foundations. Is there no danger that towering and impressive constructions of economic speculation are being erected both in the United States and in Europe with too little effort to make sure that the statistical foundation is bed-rock? Is there no danger that some of these may prove ultimately to be ill-founded? This is a peril against which mathematical statisticians may need to be warned. To voice that warning, I cite two examples from the mistakes of mathematical geniuses.

Before and for many years after 1790, when the United States took the first national census on record, the opinion was current among European statisticians that to enumerate a country's population was impracticable. Needing to know the population of France, Laplace secured a count of the residents in certain scattered districts and also of the annual number of registered births. These facts gave him a ratio between births and population which he applied to the whole of France. The process was legitimate, but in defending it Laplace went into an elaborate mathematical demonstration showing with pages of formulæ that there was not one chance in one thousand that the error of his estimated population would exceed 500,000. Today it is demonstrable that his estimated popu-

lation was under the truth by more than 2,000,000, or 9 per cent. of the total, and that the mistake lay not in his mathematics but in the number of registered births in France, to which he applied his ratio.*

If any mathematician held a position in the United States at the end of the nineteenth century comparable to that held by Laplace in France at its beginning, it was probably Simon Newcomb. Because of his eminence, I venture to feather my warning shaft with an example from his statistics. In his brief *Statistical Inquiry into Sex in Human Offspring*† a main object was to show that "the treatment of statistical data generally on a large scale by the rigorous methods of probable induction leads one into a field the cultivation of which promises important results to the science of the future."‡ The first of his six conclusions was: "The preponderance of male over female births probably varies with the race . . . it seems to be either non-existent or quite small in the negro race." This conclusion was founded entirely upon census figures§ which are subject to a margin of biased error, so wide that they have no probative value. Furthermore, the conclusion is directly contradicted by the few American registration figures of births by race and sex,—to which no reference was made, although the best of them were published by the city in which the article was probably written.

The keen interest in economic or statistical theory, which expresses itself more and more often in a mathematical dress, is not infrequently associated with a distaste for the patient and competent testing of the basic facts. This

* The earliest and fullest statement of Laplace's argument is in his contributions to *Histoire de l'Académie Royale des Sciences* for 1783, printed at Paris in 1786. After several unsuccessful inquiries of the larger American libraries, these volumes were found in the library of the American Philosophical Society at Philadelphia, which kindly sent them to Ithaca for my use. Laplace clung to this method at least until 1814, when his *Essai Philosophique sur les Probabilités* appeared (See *Oeuvres Complètes*, 1843-47, Vol. VII, pp. lvi, f.) and his disciple Quetelet until 1827, when its keen criticism by de Keverberg won Quetelet over to the method of enumeration, of which he soon became the most convincing and effective advocate. My criticism applies to the form of Laplace's estimate set forth in his *Essai Philosophique*, when it can be tested by census and registration figures. For evidence that his estimated population of France, 28,352,845 in 1802, was below the census figures and that those were below the truth, see Jacques Bertillon's *Stat. Intern. résultant des Recensements* (1899), pp. 30-31.

† Simon Newcomb, *A Statistical Inquiry into the Probability of Causes of the Production of Sex in Human Offspring*, Carnegie Institution of Washington, 1904.

‡ *Id.*, Prefatory Note.

§ *Id.*, p. 8.

neglect may lead to building structures on foundations of sand and to compromising the reputation of our guilds in their collapse. Certainly the contrast between the magnitude of the superstructure and the slipperiness of the foundation is often glaringly apparent to those who have struggled in deep waters to lay the foundation and is in no slight degree responsible for the attitude of quizzical aloofness with which these structures are viewed by some who know much about their basis.

I dwell upon this suggestion because I have long believed it to be needed and perhaps never more than now when the growing enthusiasm for mathematical statistics in Europe and the United States and the inability of many producers of official statistics to follow or criticize intelligently the interpretation placed upon their own figures may result in reviving a separation, which I hoped was of the past, into groups of official and private statisticians, each somewhat ill-informed about the other.

The most serious obstacle to sound work in federal statistics is probably the over-emphasis upon its political aspects. All official statistics are political and in a sense partisan; they cannot be entirely divorced from politics within any future period of importance to the present discussion, yet for a century their scientific or rational meaning has been slowly gaining recognition. This change it is the duty and privilege of our Associations to support and urge forward. To that end we need to provide in our universities better training for statisticians, public or private, and to instil into them a sense of the scientific value of their work. We need to exercise an influence in favor of long terms of service for statisticians who have earned retention and for the promotion of those who show natural aptitude. Perhaps nothing would further this purpose better than to see some of our large offices become training schools in producing the future official statisticians of the country. They are not now trained in our universities and they cannot be well trained without enjoying the laboratory experience of a well-managed office. Universities situated near such laboratories might profitably arrange collaboration with them, like that between medical schools and

hospitals or that between many European universities and the statistical offices of the cities in which they are situated. In this respect the Bureau of the Census has proved a disappointment. It has done little to train men so that they could rise to higher positions in the office and in so doing lift the office staff to higher levels of efficiency; much less I believe than the Coast Survey or the Geological Survey or the Bureau of Corporations has done. Largely as a result of this over-emphasis upon the political aspects of its work and neglect to train men for promotion, the quality of federal statistics is not improving as fast as the quality of statistics in private corporations or the quality of federal work in geology or geodesy. Perhaps, indeed, the deterioration is absolute as well as relative.

What should these Associations do toward improving federal statistics?

For the present, I have but one suggestion. It would be expedient, I believe, for each Association to appoint a committee on federal statistics, with power to enlarge its membership, and to coöperate with the corresponding committee of the other Association. These two committees might divide the field of federal statistics between them and start a person at work if possible on each main field. Each coöperator would be invited to prepare a report on the recent progress and present condition of statistics within the field assigned him and to embody recommendations for its future improvement. The reports would be laid before the main committee for editing. Those which received its approval would then be submitted to the Associations for printing.

In this manner our Associations might secure for themselves and the public a series of deliberate, reasoned and expert opinions upon the subject of our conference. If this effort should prove successful, it would aid us in deciding whether further steps were desirable. Perhaps the time would be found ripe for an expression of opinion from one or both of these Associations regarding federal work in statistics or certain branches of it which would influence it helpfully in the future as similar expressions of opinion from these and other learned societies have helped it in the past.